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# Vital Statistics of Massachusetts for 1897, with a Life Table

BASED UPON THE EXPERIENCE OF THE FIVE-YEAR PERIOD 1893–97.

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# THE VITAL STATISTICS OF MASSACHUSETTS FOR 1897, WITH A LIFE TABLE BASED UPON THE EXPERIENCE OF THE FIVE-YEAR PERIOD 1893-97.

The following brief digest embraces the vital statistics of the State for the year 1897, to which has been appended a life table, constructed mainly from the State census of 1895, and the mortality of the years 1893, '94, '95, '96 and '97.

## POPULATION.

The assumed population in 1897, based upon the rate of increase from 1890 to 1895, was 2,613,023. Assuming the rate of increase of each sex to have been the same as that of the five-year period 1890–95, the males were 1,269,556 and the females, 1,343,467.

The number of registered marriages was 23,038; of births, 73,205; and of deaths, 47,419.

## MARRIAGES.

The total number of marriages was 23,038, and the marriage-rate was 8.82 per 1,000 of the living population, or 17.64 per 1,000 (persons married). The following table expresses the seasonal marriage-rate for 1897 and for the period 1876–95 : —

*Marriages by Months, Quarters and Half-years.*

| | Marriages, 1897. | MONTHLY RATIO REDUCED TO A DAILY STANDARD OF 100. | | | 20 Years — 1876-95. |
|---|---|---|---|---|---|
| | | Months. | Quarters. | Half-years. | |
| January, | 1,738 | 89.2 | | | 97.0 |
| February, | 1,563 | 88.8 | 79.4 | | 92.4 |
| March, | 1,188 | 61.0 | | 96.6 | 54.9 |
| April, | 1,862 | 98.8 | | | 101.8 |
| May, | 1,553 | 79.7 | 113.6 | | 89.5 |
| June, | 3,082 | 163.5 | | | 126.2 |
| July, | 1,537 | 78.9 | | | 82.1 |
| August, | 1,607 | 82.5 | 92.2 | | 80.1 |
| September, | 2,187 | 116.0 | | 104.2 | 112.0 |
| October, | 2,571 | 132.0 | | | 129.4 |
| November, | 2,569 | 136.3 | 116.2 | | 147.8 |
| December, | 1,581 | 81.2 | | | 89.1 |
| Total, | 23,038 | – | – | – | – |
| Mean, | – | 100.0 | – | – | 100.0 |

## BIRTHS.

The living births in 1897 were 73,205, and the birth-rate was 28.02 per 1,000. This rate was less than that of 1896, but greater than that of any previous year since 1874, except those of 1892 and 1893. The birth-rate of the twenty-year period 1876–95 was 25.86. The following table expresses the seasonal birth-rate for 1897 and for the period 1876–95 : —

*Births by Months, Quarters and Half-years (1897 and 1876–95).*

| MONTHS. | | | | | | | Births. | MONTHLY RATIO REDUCED TO A STANDARD OF 100 PER DAY. | | | 20 Years — 1876-95. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Months. | Quarters. | Half-years. | |
| January, | . | . | . | . | . | . | 6,265 | 100.8 | 101.3 | 97.2 | 95.6 |
| February, | . | . | . | . | . | . | 5,634 | 100.3 | | | 98.6 |
| March, | . | . | . | . | . | . | 6,388 | 102.7 | | | 98.0 |
| April, | . | . | . | . | . | . | 5,705 | 94.8 | 93.5 | | 94.9 |
| May, | . | . | . | . | . | . | 5,665 | 91.1 | | | 94.0 |
| June, | . | . | . | . | . | . | 5,693 | 94.6 | | | 98.1 |
| July, | . | . | . | . | . | . | 6,356 | 102.2 | 104.6 | 102.6 | 104.1 |
| August, | . | . | . | . | . | . | 6,708 | 107.9 | | | 106.6 |
| September, | . | . | . | . | . | . | 6,238 | 103.7 | | | 104.4 |
| October, | . | . | . | . | . | . | 6,330 | 101.8 | 100.6 | | 101.3 |
| November, | . | . | . | . | . | . | 6,015 | 99.97 | | | 101.5 |
| December, | . | . | . | . | . | . | 6,208 | 99.8 | | | 102.7 |
| Total, | . | . | . | . | . | . | 73,205 | 100.0 | 100.0 | 100.0 | 100.0 |

The order of intensity was as follows, beginning with the month having the highest daily birth-rate : August, September, March, July, October, January, February, November, December, April, June, May. This corresponds fairly with the normal means for the period 1876–95, in which the months having the highest daily birth-rates were August and September, and the lowest in May. For the past forty years the last half of each year has usually had a higher birth-rate than the first half, but the difference which existed at the early part of the period has gradually been growing less.

*Still-births.* — The number of still-births registered was 2,652, of which number 1,636 were males, 1,005 were females, and the sex of 11 was not stated. The ratio of males to females was as 1,628 to 1,000. The total number of births living and dead was 75,857.

*Sexes.* — Of the total number of living births, 37,689 were males and 35,489 were females, being in the ratio of 1,062 males to each

1,000 females.  In this estimate 27 births are excluded, the sex of which was not stated.

The births for the period 1876–95 indicated a ratio of 10.53 males to 1,000 females.

## DEATHS.

The registered deaths in 1897 were 47,419 and the death-rate was 18.15.  This was lower than that of any year since 1879, and, with the exception of 1878 and 1879, the lowest since 1867.

*Sex.* — Of the whole number of deaths, excluding the still-born, 24,004 were males and 23,415 were females.  The death-rate of males was 18.91 per 1,000 and that of females 17.39 upon the assumed population as stated on page 799.

*Ages.* — The most important factor in the general death-rate is the death-rate of infants under one year, which is usually expressed as a ratio per 1,000 births, since the census enumeration at the early years of life is unreliable.  The numbers dying at this period are high both absolutely and relatively, while those who die at extreme old age are only relatively high in number.  For more accurate information on this subject the life tables following this summary may be consulted.

The deaths under one year in 1897 were 10,751, which was equivalent to a death-rate of 146.9 per 1,000 births.  The deaths at the next ages of life were as follows : second year, 2,257 ; third year, 1,058 ; fourth, 744 ; fifth, 493 ; and for the two five-year periods 5–10 and 10–15, 1,287 and 682.  For the death-rates at these and later ages see life table.

### Infant Mortality.

In the twenty-eighth annual report of the Board, page 753, a table is presented, giving the statistics relative to infant mortality in each of the 32 cities of the State for the ten years 1881–90.

In the following table the figures are presented for the next seven years, 1891–97, with two parallel columns, by means of which the rank of each city may be compared for the two periods.

In these two last columns the infant mortality of the State is taken as a standard of comparison, or mean of the whole period, the figure

100 representing the mean. The results may be read as follows: for every 100 deaths of infants under one year old which occurred in the State during the seven years 1891–97, there were 165 in Fall River, 107 in Boston, 71 in Beverly, etc.

Comparing these columns, there appears to have been a diminished infantile death-rate in the latter period in the following cities: Boston, Lawrence, Salem, Holyoke, Cambridge, Chelsea, Springfield, Haverhill, Marlborough, Pittsfield, Worcester, Somerville, Brockton, Medford, Malden, Waltham and Beverly, and in the remaining cities it was increased.

The death-rate of the whole urban group was also diminished from 174.9 per 1,000 births in the entire period to 164.2 in the later period. That of the rural group, comprising the remainder of the State, remained practically the same (129.5) in both periods, while that of the whole State diminished from 160.4 per 1,000 births to 154.6.

*Infant Mortality of Cities, 1891–97.*

| CITIES. | Births. | Deaths 0-1. | Infant Mortality. | RANK — THE STATE = 100. | |
|---|---|---|---|---|---|
| | | | | 1891-97. | 1881-90. |
| Fall River, . . . | 20,910 | 5,339 | 255.3 | 165 | 149 |
| Lowell, . . . | 18,397 | 4,185 | 227.5 | 147 | 139 |
| Chicopee, . . . | 4,282 | 917 | 214.2 | 139 | 110 |
| Lawrence, . . . | 10,788 | 2,163 | 200.5 | 130 | 133 |
| New Bedford, . . | 12,389 | 2,478 | 200.0 | 129 | 111 |
| Salem, . . . . | 6,574 | 1,106 | 168.2 | 109 | 112 |
| Boston, . . . | 108,139 | 17,834 | 164.9 | 107 | 117 |
| Newburyport, . . | 2,250 | 364 | 161.8 | 105 | 95 |
| Taunton, . . . | 5,031 | 788 | 156.6 | 101 | 87 |
| Holyoke, . . . | 11,609 | 1,817 | 156.5 | 101 | 105 |
| Cambridge, . . . | 17,038 | 2,590 | 152.0 | 98 | 107 |
| Chelsea, . . . | 6,614 | 998 | 150.9 | 98 | 104 |
| Springfield, . . . | 10,001 | 1,459 | 145.9 | 94 | 98 |
| Haverhill, . . . | 5,870 | 835 | 142.2 | 92 | 98 |

*Infant Mortality of Cities, 1891–97* — Concluded.

| CITIES. | Births. | Deaths 0-1. | Infant Mortality. | RANK — THE STATE = 100. | |
|---|---|---|---|---|---|
| | | | | 1891-97. | 1881-90. |
| Gloucester, . . . | 4,654 | 655 | 140.7 | 91 | 86 |
| Lynn, . . . | 11,473 | 1,608 | 140.2 | 91 | 88 |
| Woburn, . . . | 3,058 | 425 | 139.0 | 90 | 79 |
| Fitchburg, . . | 6,273 | 865 | 137.9 | 89 | 84 |
| Everett, . . . | 4,057 | 552 | 136.0 | 88 | 82 |
| Marlborough, . . | 2,958 | 400 | 135.2 | 87 | 96 |
| Pittsfield, . . . | 3,766 | 505 | 134.1 | 87 | 90 |
| Northampton, . . | 2,711 | 362 | 133.5 | 86 | 86 |
| Worcester, . . | 20,659 | 2,738 | 132.5 | 86 | 97 |
| Somerville, . . . | 9,866 | 1,295 | 131.3 | 85 | 96 |
| North Adams, . . | 4,600 | 600 | 130.4 | 84 | 72 |
| Brockton, . . . | 5,381 | 687 | 127.7 | 83 | 91 |
| Newton, . . . | 4,847 | 600 | 123.8 | 80 | 70 |
| Quincy, . . . | 4,681 | 555 | 118.6 | 77 | 77 |
| Melrose,* . . . | 1,854 | 217 | 117.0 | 76 | – |
| Medford, . . . | 2,530 | 291 | 115.0 | 74 | 81 |
| Malden, . . . | 5,667 | 650 | 114.7 | 74 | 83 |
| Waltham, . . . | 3,786 | 424 | ·112.0 | 72 | 82 |
| Beverly, . . . | 1,733 | 191 | 110.2 | 71 | 74 |
| Urban, . . . | 344,039 | 56,493 | 164.2 | 106 | 109 |
| Rural, . . . | 132,119 | 17,113 | 129.5 | 84 | 80 |
| THE STATE, . . | 476,158 | 73,606 | 154.6 | 100 | 100 |

* The figures for Melrose are introduced to facilitate future comparison, although that town had not become a city till after the period embraced in the table.

From an examination of the statistics of other towns having over 5,000 inhabitants in each, it appears that the town of Framingham

had the lowest infantile mortality (95.9) for the seven years, while
Rockport had the highest (203.3 per 1,000 births).  Further ex-
amination of the record shows that this high infantile mortality in
Rockport occurred mainly among infants whose parents were natives
of Finland, who were employed upon the granite quarries in Rock-
port.

The following table presents the infantile mortality of the towns
having over 5,000 inhabitants in each (not cities), arranged with
those having the highest infantile death-rates at the top of the list.

*Infant  Mortality  of  Towns  having  more  than  5,000  Inhabitants  in  Each  (not
Cities), 1891–97.*

[Deaths (0–1) per 1,000 births.]

| | | | | |
|---|---|---|---|---|
| Rockport, | 203.3 | | Athol, | 130.8 |
| Stoughton, | 188.2 | | Montague, | 129.2 |
| Palmer, | 171.7 | | Peabody, | 128.1 |
| Ware, | 171.2 | | Spencer, | 127.9 |
| Northbridge, | 170.7 | | Clinton, | 125.1 |
| Braintree, | 164.4 | | Concord, | 124.6 |
| Gardner, | 163.2 | | Hyde Park, | 123.7 |
| Revere, | 162.1 | | Dedham, | 121.5 |
| West Springfield, | 159.5 | | Orange, | 120.3 |
| Southbridge, | 159.2 | | Watertown, | 118.9 |
| Grafton, | 154.4 | | Stoneham, | 117.3 |
| Hudson, | 148.8 | | Westfield, | 116.9 |
| Millbury, | 147.9 | | Franklin, | 112.8 |
| Wakefield, | 145.6 | | Greenfield, | 112.5 |
| Milton, | 145.4 | | Natick, | 109.8 |
| Webster, | 143.5 | | Whitman, | 108.0 |
| Methuen, | 142.4 | | Andover, | 106.2 |
| Weymouth, | 140.4 | | North Attleborough, | 105.2 |
| Marblehead, | 139.5 | | Plymouth, | 104.5 |
| Arlington, | 138.8 | | Rockland, | 103.5 |
| Adams, | 137.7 | | Milford, | 103.4 |
| Winchester, | 135.4 | | Brookline, | 101.4 |
| Attleborough, | 135.0 | | Danvers, | 99.4 |
| Amesbury, | 134.2 | | Westborough, | 96.9 |
| Leominster, | 134.0 | | Middleborough, | 96.8 |
| Blackstone, | 133.3 | | Framingham, | 95.9 |

The total living births which furnished the infantile mortality
represented in these two periods (shown in the twenty-eighth

annual report and in the present report) were nearly 1,000,000 (985,445), and the deaths under one year were 155,277.

*Seasons of the Year.* — The seasonal intensity of the death-rate is expressed in the following table. The standard employed for comparison is 100 deaths per day throughout the year. The actual number of daily deaths in 1897 was 129.9.

*Deaths by Months, Quarters and Half-years (1897 and 1876–95).*

| MONTHS. | | | | | | | Deaths. | 1897. MONTHLY RATIO REDUCED TO A STANDARD OF 100 DEATHS PER DAY. | | | 20 Years — 1876-95. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Months. | Quarters. | Half-years. | |
| January, | . | . | . | . | . | . | 4,051 | 100.6 | | | 105.0 |
| February, | . | . | . | . | . | . | 3,929 | 108.0 | 108.7 | | 100.0 |
| March, | . | . | . | . | . | . | 4,730 | 120.2 | | 101.5 | 102.3 |
| April, | . | . | . | . | . | . | 4,057 | 104.1 | | | 102.1 |
| May, | . | . | . | . | . | . | 3,805 | 94.4 | 94.3 | | 93.9 |
| June, | . | . | . | . | . | . | 3,291 | 84.4 | | | 83.5 |
| July, | . | . | . | . | . | . | 4,254 | 105.6 | | | 109.3 |
| August, | . | . | . | . | . | . | 4,566 | 113.4 | 107.0 | | 120.0 |
| September, | . | . | . | . | . | . | 3,969 | 101.8 | | 98.5 | 104.5 |
| October, | . | . | . | . | . | . | 3,806 | 94.5 | | | 93.1 |
| November, | . | . | . | . | . | . | 3,475 | 89.1 | 90.1 | | 88.9 |
| December, | . | . | . | . | . | . | 3,486 | 86.6 | | | 96.6 |
| Totals, | . | . | . | . | . | . | 47,419 | – | – | – | – |
| Means, | . | . | . | . | . | . | – | 100.0 | 100.0 | 100.0 | 100.0 |

By this table it appears that the greatest intensity of the seasonal death-rate was in March and in August and the least was in May and June, in 1897, while the highest in the twenty-year period (1876–95) was in July and August and the lowest was in June and November.

## CAUSES OF DEATH.

In the following table are presented the ten most destructive causes and groups of causes of death in Massachusetts for the ten-year period, 1888–97, arranged in the order of their intensity. From this table it appears that the relative intensity of consumption, brain diseases, pneumonia, heart diseases and cholera infantum continued very much in the same order throughout the period. The only change in the table, as compared with that of 1896, is in the last two causes, diphtheria and croup having taken the tenth place in the list, instead of the ninth. The total number of deaths from these causes was 29,875, as compared with 31,146 in 1896, a

difference of 1,271 in favor of 1897. The deaths from consumption, brain diseases, heart diseases, cholera infantum, cancer, old age and diphtheria were less than those of 1896, while those from pneumonia, kidney diseases and bronchitis were more than those of 1896 from the same causes.

In the tables on pages 807–809 are presented the deaths and death-rates from fifteen causes of death for the twenty years 1878–97. These include the principal infectious diseases, together with certain other destructive causes and groups of causes.

The columns contain the absolute numbers in each case, together with the death-rate per 10,000 of the living population and the percentage of the total mortality.

From this table it appears that the death-rate from small-pox, measles, scarlet fever, diphtheria, typhoid fever, cholera infantum, child-birth, consumption, dysentery and whooping-cough in 1897 was less than the mean of the twenty-year period 1878–97, while that of pneumonia, cancer, heart diseases, kidney diseases and brain diseases was greater than the twenty-year mean.

*Mortality from Ten Prominent Causes, 1888–97.*

| CAUSES OF DEATH. | Deaths. 1897. | RANK — 1888-97. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1897. | 1896. | 1895. | 1894. | 1893. | 1892. | 1891. | 1890. | 1889. | 1888. |
| Consumption, . . | 5,431 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Brain diseases, . . | 5,276 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 |
| Pneumonia, . . . | 4,796 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| Heart diseases, . . | 3,827 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Cholera infantum, . | 2,231 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 6 | 5 | 5 |
| Kidney diseases, . . | 2,017 | 6 | 6 | 6 | 7 | 8 | 8 | 8 | 9 | 9 | 9 |
| Cancer, . . . | 1,739 | 7 | 7 | 8 | 10 | 9 | 10 | 9 | 8 | 8 | 10 |
| Old age, . . . | 1,602 | 8 | 8 | 9 | 8 | 6 | 6 | 6 | 7 | 7 | 6 |
| Bronchitis, . . . | 1,530 | 9 | 10 | 10 | 9 | 7 | 7 | 7 | 10 | 10 | 8 |
| Diphtheria and croup, . | 1,426 | 10 | 9 | 7 | 6 | 10 | 9 | 10 | 5 | 6 | 7 |
| | 29,875 | – | – | – | – | – | – | – | – | – | – |

STATISTICS OF CERTAIN CAUSES OF DEATH, MASSACHUSETTS, 1878-97.

*Deaths, and Ratios compared with Population and Total Mortality.*

| YEARS. | SMALL-POX. | | | MEASLES. | | | SCARLET FEVER. | | | DIPHTHERIA AND CROUP. | | | TYPHOID FEVER. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. |
| 1878, | 2 | .01 | .01 | 305 | 1.8 | .97 | 404 | 2.3 | 1.29 | 2,517 | 14.6 | 8.04 | 679 | 3.9 | 2.17 |
| 1879, | 7 | .04 | .02 | 19 | 0.1 | .06 | 850 | 4.8 | 2.67 | 2,293 | 13.1 | 7.21 | 637 | 3.6 | 2.00 |
| 1880, | 38 | .21 | .11 | 236 | 1.3 | .67 | 574 | 3.2 | 1.63 | 2,394 | 13.4 | 6.78 | 882 | 4.9 | 2.50 |
| 1881, | 47 | .26 | .13 | 230 | 1.3 | .63 | 397 | 2.2 | 1.09 | 2,383 | 13.1 | 6.54 | 1,072 | 5.9 | 2.94 |
| 1882, | 45 | .24 | .12 | 68 | 0.4 | .18 | 318 | 1.7 | 0.86 | 1,771 | 9.6 | 4.81 | 1,079 | 5.8 | 2.93 |
| 1883, | 5 | .03 | .01 | 321 | 1.7 | .85 | 575 | 3.1 | 1.52 | 1,621 | 8.6 | 4.29 | 860 | 4.6 | 2.28 |
| 1884, | 3 | .02 | .01 | 75 | 0.4 | .20 | 627 | 3.3 | 1.69 | 1,646 | 8.6 | 4.45 | 875 | 4.6 | 2.37 |
| 1885, | 19 | .10 | .05 | 313 | 1.6 | .82 | 587 | 3.0 | 1.54 | 1,523 | 7.8 | 4.00 | 768 | 3.9 | 2.02 |
| 1886, | - | - | - | 130 | 0.6 | .35 | 331 | 1.7 | 0.89 | 1,558 | 7.8 | 4.18 | 800 | 4.0 | 2.15 |
| 1887, | 3 | .01 | .007 | 455 | 2.2 | 1.12 | 594 | 2.9 | 1.46 | 1,628 | 7.9 | 3.99 | 922 | 4.5 | 2.26 |
| 1888, | 8 | .04 | .02 | 219 | 1.0 | .52 | 504 | 2.4 | 1.20 | 1,831 | 8.7 | 4.35 | 943 | 4.5 | 2.24 |
| 1889, | 6 | .03 | .01 | 171 | 0.8 | .41 | 185 | 0.9 | 0.44 | 2,214 | 10.2 | 5.30 | 891 | 4.1 | 2.13 |
| 1890, | 1 | .004 | .002 | 114 | 0.5 | .26 | 196 | 0.9 | 0.45 | 1,626 | 7.3 | 3.74 | 835 | 3.7 | 1.92 |
| 1891, | 1 | .004 | .002 | 236 | 1.0 | .52 | 246 | 1.1 | 0.54 | 1,218 | 5.3 | 2.70 | 821 | 3.6 | 1.82 |
| 1892, | 2 | .01 | .004 | 88 | 0.4 | .18 | 669 | 2.9 | 1.37 | 1,455 | 6.2 | 2.98 | 827 | 3.5 | 1.70 |
| 1893, | 9 | .04 | .02 | 276 | 1.2 | .56 | 810 | 3.4 | 1.65 | 1,394 | 5.8 | 2.84 | 750 | 3.1 | 1.53 |
| 1894, | 33 | .13 | .07 | 98 | 0.4 | .21 | 649 | 2.6 | 1.39 | 1,801 | 7.4 | 3.85 | 748 | 3.1 | 1.60 |
| 1895, | - | - | - | 117 | 0.5 | .25 | 483 | 1.9 | 1.02 | 1,784 | 7.1 | 3.75 | 680 | 2.7 | 1.43 |
| 1896, | - | - | - | 137 | 0.5 | .28 | 249 | 1.0 | 0.50 | 1,677 | 6.6 | 3.40 | 723 | 2.8 | 1.46 |
| 1897, | 4 | .02 | .008 | 158 | 0.6 | .33 | 342 | 1.3 | 0.72 | 1,426 | 5.5 | 3.01 | 607 | 2.3 | 1.28 |
| Totals and means, | 233 | .06 | .03 | 3,766 | 0.9 | .46 | 9,590 | 2.3 | 1.16 | 35,760 | 8.4 | 4.34 | 16,399 | 3.9 | 1.99 |

STATISTICS OF CERTAIN CAUSES OF DEATH, MASSACHUSETTS, 1878–97 — *Continued.*

*Deaths, and Ratios compared with Population and Total Mortality* — Continued.

| YEARS | CHOLERA INFANTUM | | | CONSUMPTION | | | CHILD-BIRTH | | | | DYSENTERY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deaths | Death-rate per 10,000 Living | Percentage of Total Mortality | Deaths | Death-rate per 10,000 Living | Percentage of Total Mortality | Deaths | Death-rate per 10,000 Living | Percentage of Total Mortality | Percentage of Births | Deaths | Death-rate per 10,000 Living |
| 1878, | 1,573 | 9.1 | 5.02 | 5,334 | 30.8 | 17.04 | 297 | 1.7 | 0.95 | .706 | 602 | 3.5 |
| 1879, | 1,349 | 7.7 | 4.24 | 5,223 | 29.7 | 16.42 | 300 | 1.7 | 0.94 | .728 | 372 | 2.1 |
| 1880, | 2,118 | 11.9 | 6.00 | 5,494 | 30.8 | 16.57 | 316 | 1.8 | 0.90 | .700 | 395 | 2.2 |
| 1881, | 1,861 | 10.3 | 5.10 | 5,886 | 32.4 | 16.14 | 370 | 2.0 | 1.01 | .799 | 360 | 2.0 |
| 1882, | 2,159 | 11.7 | 5.87 | 5,865 | 31.8 | 15.94 | 351 | 1.9 | 0.95 | .751 | 398 | 2.2 |
| 1883, | 1,941 | 10.3 | 5.14 | 5,931 | 31.6 | 15.71 | 366 | 1.9 | 0.97 | .755 | 336 | 1.8 |
| 1884, | 2,081 | 10.9 | 5.63 | 5,798 | 30.4 | 15.67 | 323 | 1.7 | 0.87 | .649 | 254 | 1.3 |
| 1885, | 1,852 | 9.5 | 4.86 | 5,955 | 30.7 | 15.63 | 350 | 1.8 | 0.92 | .700 | 253 | 1.3 |
| 1886, | 1,931 | 9.7 | 5.18 | 5,897 | 29.5 | 15.83 | 303 | 1.5 | 0.81 | .581 | 243 | 1.2 |
| 1887, | 2,131 | 10.4 | 5.23 | 5,871 | 28.6 | 14.40 | 280 | 1.4 | 0.69 | .514 | 266 | 1.3 |
| 1888, | 2,195 | 10.4 | 5.21 | 5,728 | 27.1 | 13.61 | 277 | 1.3 | 0.66 | .491 | 248 | 1.2 |
| 1889, | 2,156 | 9.9 | 5.16 | 5,581 | 25.7 | 13.36 | 303 | 1.4 | 0.73 | .517 | 299 | 1.4 |
| 1890, | 2,491 | 11.1 | 5.72 | 5,791 | 25.9 | 13.31 | 365 | 1.6 | 0.84 | .615 | 220 | 1.0 |
| 1891, | 2,771 | 12.1 | 6.13 | 5,484 | 24.0 | 12.14 | 269 | 1.2 | 0.60 | .416 | 234 | 1.0 |
| 1892, | 2,898 | 12.4 | 5.94 | 5,739 | 24.5 | 11.77 | 343 | 1.5 | 0.70 | .508 | 193 | 0.8 |
| 1893, | 2,704 | 11.3 | 5.51 | 5,527 | 23.1 | 11.26 | 317 | 1.3 | 0.65 | .459 | 231 | 1.0 |
| 1894, | 2,676 | 10.9 | 5.72 | 5,463 | 22.3 | 11.67 | 325 | 1.3 | 0.69 | .474 | 216 | 0.9 |
| 1895, | 2,377 | 9.5 | 5.00 | 5,486 | 21.9 | 11.54 | 380 | 1.5 | 0.80 | .549 | 209 | 0.8 |
| 1896, | 2,957 | 11.6 | 5.99 | 5,536 | 21.7 | 11.21 | 328 | 1.3 | 0.66 | .453 | 407 | 1.6 |
| 1897, | 2,231 | 8.5 | 4.70 | 5,431 | 20.8 | 11.45 | 314 | 1.2 | 0.66 | .429 | 209 | 0.8 |
| Totals and means, | 44,452 | 10.5 | 5.39 | 113,020 | 26.7 | 13.72 | 6,477 | 1.5 | 0.79 | .583 | 5,945 | 1.4 |

STATISTICS OF CERTAIN CAUSES OF DEATH, MASSACHUSETTS, 1878-97 — *Concluded.*

*Deaths, and Ratios compared with Population and Total Mortality* — Concluded.

| YEARS. | PNEUMONIA. | | | WHOOPING-COUGH. | | | CANCER. | | | KIDNEY DISEASES. | | | HEART DISEASES. | | | BRAIN DISEASES. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. | Deaths. | Death-rate per 10,000 Living. | Percentage of Total Mortality. |
| 1878, | 2,171 | 12.6 | 6.93 | 400 | 2.3 | 1.28 | 807 | 4.7 | 2.58 | 615 | 3.6 | 1.96 | 1,442 | 8.3 | 4.61 | 2,778 | 16.1 | 8.87 |
| 1879, | 2,647 | 15.1 | 8.32 | 302 | 1.7 | 0.95 | 862 | 4.9 | 2.71 | 693 | 3.9 | 2.18 | 1,515 | 8.6 | 4.76 | 2,820 | 16.1 | 8.87 |
| 1880, | 3,076 | 17.3 | 8.72 | 230 | 1.3 | 0.65 | 928 | 5.2 | 2.63 | 698 | 3.9 | 1.98 | 1,726 | 9.7 | 4.89 | 3,210 | 18.0 | 9.10 |
| 1881, | 2,967 | 16.4 | 8.14 | 217 | 1.2 | 0.59 | 949 | 5.2 | 2.60 | 825 | 4.5 | 2.26 | 1,937 | 10.7 | 5.31 | 3,355 | 18.5 | 9.20 |
| 1882, | 2,932 | 15.9 | 7.97 | 265 | 1.4 | 0.72 | 987 | 5.3 | 2.68 | 877 | 4.7 | 2.38 | 2,025 | 11.0 | 5.50 | 3,393 | 18.4 | 9.22 |
| 1883, | 3,045 | 16.2 | 8.07 | 137 | 0.7 | 0.36 | 1,026 | 5.5 | 2.72 | 959 | 5.1 | 2.54 | 2,153 | 11.5 | 5.70 | 3,562 | 19.0 | 9.44 |
| 1884, | 2,646 | 13.9 | 7.15 | 410 | 2.1 | 1.11 | 1,060 | 5.6 | 2.87 | 1,000 | 5.2 | 2.70 | 2,117 | 11.1 | 5.72 | 3,669 | 19.2 | 9.92 |
| 1885, | 3,468 | 17.9 | 9.10 | 184 | 0.9 | 0.48 | 1,087 | 5.6 | 2.85 | 1,088 | 5.6 | 2.86 | 2,227 | 11.5 | 5.85 | 3,894 | 20.0 | 10.22 |
| 1886, | 2,836 | 14.2 | 7.61 | 271 | 1.4 | 0.73 | 1,104 | 5.5 | 2.96 | 1,135 | 5.7 | 3.05 | 2,325 | 11.6 | 6.24 | 3,844 | 19.2 | 10.32 |
| 1887, | 3,348 | 16.3 | 8.21 | 232 | 1.1 | 0.57 | 1,174 | 5.7 | 2.88 | 1,120 | 5.4 | 2.75 | 2,690 | 13.1 | 6.60 | 4,257 | 20.7 | 10.44 |
| 1888, | 3,716 | 17.6 | 8.83 | 245 | 1.2 | 0.58 | 1,275 | 6.0 | 3.03 | 1,318 | 6.2 | 3.13 | 3,061 | 14.5 | 7.27 | 4,522 | 21.4 | 10.74 |
| 1889, | 3,440 | 15.8 | 8.23 | 310 | 1.4 | 0.74 | 1,325 | 6.1 | 3.17 | 1,258 | 5.8 | 3.01 | 3,280 | 15.1 | 7.85 | 4,313 | 19.8 | 10.32 |
| 1890, | 4,058 | 18.0 | 9.28 | 363 | 1.6 | 0.83 | 1,387 | 6.2 | 3.19 | 1,273 | 5.7 | 2.92 | 3,417 | 15.3 | 7.85 | 4,389 | 19.6 | 10.08 |
| 1891, | 4,337 | 18.9 | 9.60 | 219 | 1.0 | 0.48 | 1,395 | 6.1 | 3.09 | 1,474 | 6.4 | 3.26 | 3,592 | 15.7 | 7.95 | 4,711 | 20.6 | 10.43 |
| 1892, | 5,020 | 21.5 | 10.30 | 248 | 1.1 | 0.51 | 1,402 | 6.0 | 2.88 | 1,535 | 6.6 | 3.15 | 3,733 | 16.0 | 7.65 | 5,036 | 21.5 | 10.33 |
| 1893, | 5,499 | 23.0 | 11.20 | 274 | 1.1 | 0.56 | 1,533 | 6.4 | 3.12 | 1,685 | 7.0 | 3.43 | 3,511 | 14.7 | 7.15 | 5,144 | 21.5 | 10.48 |
| 1894, | 4,101 | 16.8 | 8.76 | 435 | 1.8 | 0.98 | 1,568 | 6.4 | 3.35 | 1,721 | 7.0 | 3.68 | 3,432 | 14.0 | 7.33 | 4,995 | 20.4 | 10.67 |
| 1895, | 4,652 | 18.6 | 9.79 | 269 | 1.1 | 0.57 | 1,749 | 7.0 | 3.68 | 1,860 | 7.4 | 3.91 | 3,566 | 14.3 | 7.50 | 5,062 | 20.2 | 10.65 |
| 1896, | 4,703 | 18.4 | 9.52 | 282 | 1.1 | 0.57 | 1,798 | 7.0 | 3.64 | 1,945 | 7.6 | 3.94 | 3,664 | 14.3 | 7.42 | 5,404 | 21.2 | 10.95 |
| 1897, | 4,796 | 18.4 | 10.11 | 171 | 0.7 | 0.36 | 1,737 | 6.6 | 3.66 | 1,943 | 7.4 | 4.10 | 3,615 | 13.8 | 7.62 | 5,276 | 20.2 | 11.13 |
| Totals and means, | 73,488 | 17.3 | 8.91 | 5,464 | 1.3 | 0.66 | 25,153 | 5.9 | 3.05 | 25,022 | 5.9 | 3.04 | 55,028 | 13.0 | 6.68 | 83,631 | 19.7 | 10.15 |

A Massachusetts Life Table for the Five Years 1893–97.

The usefulness of life tables is not confined to the work of life insurance.    A life table also serves as an index of the sanitary condition of the community out of whose data it is constructed.

Life tables differ for the same group of population from year to year, and they also differ when calculated from the statistics of different portions of a group of inhabitants, as, for example, the city of Boston, compared with any of the outlying districts beyond its borders.

The work of constructing a life table for any American State or city is necessarily less satisfactory in its results than the work of making a similar table for any of the civilized nations or communities of Europe, since most foreign populations are much more stationary than our own.

The English life tables, compiled by Dr. Farr, which have proved universally useful as standards of good work in this direction, were usually calculated from the living population at two successive census enumerations and from the deaths occurring in the intervening period.    The factor of migration, however, in an American State affects the accuracy of such a calculation ; hence a somewhat different method has been employed in constructing the following table, and a shorter period of five years has been selected.    Massachusetts has an advantage not enjoyed by many communities in having an intervening State census five years after the national census, and this advantage is especially useful in any State whose population is far from stationary.

The materials selected as the basis of the following table are the census of 1895, and the deaths, numbering 240,215, which were registered in the State in the five years 1893, 1894, 1895, 1896 and 1897.    The mid-year of this period (1895) was the census year, and the census was taken very near the middle of that year (in the months of May and June).    The mean annual number of deaths at each age is compared with the population maintained at such age.

The limitations which affect the accuracy of a life table for Massachusetts are the following : —

1.    *The Effect of Migration.* — The natural increase of the population, or that which results from the excess of births over deaths, has for many years constituted only a portion of the total increase

from year to year. The census enumerations of 1890 and 1895 showed an increase of 261,240, of which number the excess of births formed only 36 per cent., the balance, 64 per cent., being the difference between the numbers of immigrants and emigrants; or, in other words, the effect of migration exceeded that of natural increase in the ratio of nearly 2 to 1.

Moreover, the increment by means of immigration is not uniform at the different age periods, fully one-half of the immigrants being between fifteen and thirty years of age, while the numbers at the extremes of life are comparatively small.

The following table presents the classified material out of which the life table is constructed: —

*Population of Massachusetts, 1895, and Deaths, 1893-97.*

| AGE PERIODS. | POPULATION, 1895. | | | DEATHS, 1893-97. | | |
|---|---|---|---|---|---|---|
| | Total. | Males. | Females. | Total. | Males. | Females. |
| 0–5, . . . . . . | 235,647* | 118,453* | 117,194* | 78,779 | 42,710 | 36,069 |
| 5–10, . . . . . . | 224,119 | 112,296 | 111,823 | 6,730 | 3,345 | 3,385 |
| 10–15, . . . . . . | 202,900 | 101,574 | 101,326 | 3,460 | 1,655 | 1,805 |
| 15–20, . . . . . . | 225,881 | 110,565 | 115,316 | 6,305 | 2,899 | 3,406 |
| 20–25, . . . . . . | 265,983 | 123,692 | 142,291 | 9,982 | 4,899 | 5,083 |
| 25–35, . . . . . . | 465,943 | 227,630 | 238,313 | 20,148 | 10,103 | 10,045 |
| 35–45, . . . . . . | 341,535 | 168,997 | 172,538 | 18,832 | 9,610 | 9,222 |
| 45–55, . . . . . . | 245,586 | 118,417 | 127,169 | 19,377 | 9,895 | 9,482 |
| 55–65, . . . . . . | 157,651 | 72,766 | 84,885 | 22,334 | 11,278 | 11,056 |
| 65–75, . . . . . . | 90,088 | 41,040 | 49,048 | 25,561 | 12,694 | 12,867 |
| 75–85, . . . . . . | 35,405 | 15,460 | 19,945 | 20,547 | 9,675 | 10,872 |
| 85–95, . . . . . . | 6,123 | 2,180 | 3,943 | 7,105 | 2,713 | 4,392 |
| Over 95, . . . . . . | 308 | 77 | 231 | 559 | 152 | 407 |
| Age unknown, . . . . | 3,014 | 1,554 | 1,460 | 496 | 378 | 118 |
| Total, . . . . . | 2,500,183 | 1,214,701 | 1,285,482 | 240,215 | 122,006 | 118,209 |

* The population figures in this line (0-5) were not used in the construction of the life table, but the figures employed were estimated from the registered births and the deaths under 5 years of age.

2. *Defects of the Census.* — Mr. Henry Gannett, in a paper contributed to the "Publications of the American Statistical Association" (Vol. IV., p. 99), estimates a "shortage in the census of 1890 of negro children of about a quarter of a million," and of the native white children "about the same." If this be correct, the entire shortage or deficiency in the total population, including that

among foreign whites, must leave at least a million unaccounted for in the United States.

A careful examination of the last two census enumerations of Massachusetts (those of 1890 and 1895) shows that Mr. Gannett's estimate is probably none too large.*

It is possible to supply the actual deficiency for the first four or five years of life, with some degree of accuracy, from the registered births; but beyond this period of life it is hardly practicable to make estimates which are of greater value than mere conjectures.

3.  *The Practice of incorrectly reporting the Ages of the Living and the Dead.* — This error is of two kinds:  (*a*) It invariably happens that greater numbers of persons are reported at the even ages, 20, 30, 40, etc. (both of the living and the dead), than at 19, 21, 29, 31, etc., in consequence of the common habit of using round numbers instead of giving the more accurate ages.  This is in a measure eliminated by employing the periods used in England, 25–35, 35–45, etc., instead of 20–30, 30–40.  (*b*)  The habit, especially noted among unmarried females, of understating the ages of the living.  This appears to a greater or less degree to be a common practice in all countries where census enumerations are made.

4.  *Defects in Birth and Death Registration.* — These defects, so far as Massachusetts is concerned, are probably insignificant, and in this respect the material collected by the registration officers of cities and towns compares favorably in its accuracy with that of foreign nations and communities having established systems of registration.  Great pains are taken in most of the municipalities to obtain accurate and full returns, since a *pro rata* fee is allowed to the local officers for them; moreover, the certifiers of births and deaths (physicians, midwives and undertakers) are compelled, under penalty, to comply with the statutes requiring such returns.

There is also a comparatively small number of persons included in the census whose sex and ages are unknown, and the same may be said of the registered deaths, the latter being probably mostly deaths of prematurely born infants, and a small number of bodies of unknown persons found dead.

Certain comments and explanatory statements are necessary in relation to the construction of the following tables.

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* Mr. E. B. Elliott also assumes an approximate shortage for the first five years of life alone of 100,000 in the United States census of 1870.  Volume on Vital Statistics, page 522.

The figures for the first five years of life have been compiled from the births, and from the deaths which occurred among children under five years of age. The census figures for these five years were disregarded, for the reasons already stated in former reports, and in accordance with the common usage in other countries.*

Dr. Farr says, in regard to this subject: "We can scarcely feel surprised to find, in the various censuses of Europe, errors in the statements of age, traceable to ambiguities of language. In the early years of life these mistakes demand attention, otherwise they may lead us into such grave mistakes as we have to notice." These well-known defects may be corrected without serious difficulty for the first years of life.

An exact and accurate life table of any population or community can be made only by taking a definite number of persons, say 100,000 or 1,000,000 at birth, and following their life history, noting the age of each person at death, until the entire number has ceased to live. Such a process is impossible, especially in an American community, subject, as it is, to the variable effect of migration.

In view of this manifest impossibility, it is therefore necessary to construct an approximate table from such data as are accessible, bearing in mind the limitations, to which reference has been made, and making such corrections of errors as are customary in the construction of similar life tables for other communities. Starting with a hypothetical 1,000,000 or 100,000 births, this generation of persons of both sexes may be followed, with a reasonable degree of accuracy, to the extinction of the last survivor, at the age of one hundred or more, by the application of the rules which it is customary to employ. In the case of Massachusetts we have selected the number 100,000 as the basis of the table, since this is the largest round number near the exact number of annual births in the State. The sexes at the time of birth are unequally distributed, the males being in the ratio of 51.350 and the females 48.650 out of each 100,000 born during the period selected for the construction of the table. These numbers are therefore taken as the numbers at birth of the two sexes, out of the hypothetical 100,000 born.

In order to eliminate the effects of epidemic years or of abnormal conditions existing in the census year 1895, the mean annual deaths

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* Twenty-sixth Annual Report Massachusetts Board of Health, page liv; also Dr. Farr's Vital Statistics, Memorial volume, page 207.

of the five years 1893–97 are employed to obtain the death-rates at each year of life. In the English life tables it has been customary to estimate the population at the middle of a given year for life-table purposes, the census being taken on the first of April. The State census of Massachusetts being taken at a time quite near the middle of the year, no allowance has been made for the few days elapsing between the time of such taking and the mid-year, since such allowance would at most only affect the second place of decimals in a death-rate expressed as a ratio per 1,000 living of a given age. Moreover, the population enumerated in May, near the middle of a five-year period, differs much less from the actual mean than that which is taken near the middle of a ten-year period, as compared with a mean of the two extremes of such period.

Dr. Billings says, in his introductory remarks in the twelfth volume of the tenth census, 1880 (page cxliii) : " The preparation for any given locality, race or occupation, *in this country*, of a life table which shall accurately represent the tendency to death or the probability of survival at each age, is practically impossible, because of the want of accuracy in the necessary data, and because of the irregular migrations of the population. It should be clearly understood that all tables of vital statistics, including data derived from large numbers of people, even when these are obtained by the most accurate census possible, and by the most complete system of registration which can be enforced, give probabilities only, and that scientific accuracy in this field is practically unattainable." The foregoing remarks apply with less force to Massachusetts than to the United States as a whole, since our own State has had a system of registration in existence since 1842, the results of which may now be considered as fairly accurate. Dr. Billings therefore publishes an approximate life table in the volume referred to for Massachusetts and for certain other communities, from such data as were obtainable for the census year 1880.

In the life table on pages 822–826 pains have been taken to make it as accurate as possible from the data at hand. The compiler is entirely responsible for whatever errors or inaccuracies it may contain.

One hundred thousand infants, followed throughout their first year during the period named, in Massachusetts, yield 90,250 years of life. To obtain this mean of the infants living throughout the first year, the following method was employed : —

All of the deaths of infants under one month old which occurred in the years 1893–97 were tabulated from the mortality returns in the office of the Secretary of State, also those of infants who died in the second and the third months of life separately, then those of infants who died in the three succeeding months of life (3–6) in one group, and then those who died in the succeeding six months in another group. From these data, and from the births registered in the five years ending with June 30, 1897, the figures for the first year of life were calculated after the method shown by Dr. Farr in his life table No. 3, page xxiii.

The foregoing mean, 90,250 (the arithmetical mean of the series $l_0$, $l_{1/12}$, $l_{2/12}$ . . . $l_1$), is used as the first term of column P (see tables 1 and 2). All of the succeeding terms in the column for the years 1, 2, 3, 4, etc., are the means of the terms in the preceding column $l_x$, using the formula $P_x = \dfrac{l_x + l_{x+1}}{2}$

The total number of persons living under five years of age in the State in 1895, as stated by the census, was 235,647; but the number as calculated from the living births in these years was 294,604, or 58,957 more than the figures of the census would indicate. No allowance is made in this estimate for migration, which would slightly increase the difference. The effect of migration at this period of life, however, is much less than at later ages, especially from fifteen to thirty years.

*Population under 5 Years.*

| | STATE CENSUS OF 1895. | Calculated from the Births and Deaths under 5. | Difference. |
|---|---|---|---|
| Males, . . . . . . | 118,453 | 149,582 | 31,129 |
| Females, . . . . . . | 117,194 | 145,022 | 27,828 |
| | 235,647 | 294,604 | 58,957 |

*Description of the Tables.*

In tables 1 and 2, column $x$, ages, presents the ages for each sex from birth up to 100 years.

Column $d_x$ presents the numbers of those dying in each age of life for each sex.

Column $l_x$ presents the survivors of each sex, out of 100,000 of both sexes, at each age of life, beginning with 51,350 males and 48,650 females at birth.

Column $P_x$ presents the population maintained by the numbers in column $l_x$.

Column $Q_x$ shows the aggregate number of years which the persons at each age in the table will live, until their extinction by death.

Column $E_x \left( = \dfrac{Q_x}{l_x} \right)$ is the mean future life time of the persons living at each age in the table, the expectation of life.

Column $m_x$ (Table 3), the mortality column, presents the mortality per unit of the population at each age of life, the figures being obtained by dividing the deaths in each age by the population at such ages, the proper corrections and interpolations having been applied. From this column $(m_x)$ the probability of living at each year of age $(p_x)$ (Table 3) is obtained by the formula $p_x = \dfrac{2 - m_x}{2 + m_x}$ applied to each year of the series.

Column $l_x$ is obtained by the formula $l_x \times p_x = l_{x+1}$, and column $P_x$ is obtained by the formula $\dfrac{l_x + l_{x+1}}{2}$.

### What may be learned from these Tables.

It appears that, out of 100,000 children born alive in Massachusetts in 1895, 16,000, or nearly one-sixth, die before arriving at the age of one year; 78,963, or nearly four-fifths, attain the age of three years; 77,051 survive the age of five years, or 77 per cent.; 50,126, or a little more than one-half, attain the age of fifty-three years; 25,406, or a little more than one-fourth, live to the age of seventy-two years.

These figures present very decided differences as compared with those which were published for 1855 by Mr. E. B. Elliott (sixteenth Massachusetts Registration Report, 1857). In those reports it was shown that the numbers dying before the close of the first year out of 100,000 born were 15,510, or very nearly the same as those for the year 1895 for the same age. At the end of three years the survivors were only 74 per cent., instead of 79 per cent., as in 1895, and that one-half had died before the close of the forty-first year, instead of surviving to the fifty-third, as in 1895.

In consequence of the fact that the numbers of each sex are unequal at birth, the males continue in greater numbers until the fifty-

third year, when the greater death-rate of the males has reduced their number below that of the females, and the females continue in excess throughout the remainder of life. Observing the table more closely, it appears that the comparative intensity of the death-rate of the sexes varies at different points in the table. For the first five years the death-rate of males exceeds that of females. From age five to age nineteen inclusive the rate of females exceeds that of males, and from age twenty to the end of life the death-rate of females is less than that of males.

In Table 3 are presented two columns in which are shown the probability of living one year from each age and the mortality per unit of the population at each year. At birth the probability of living a year is for males .82569 and for females .84939, that of boys at birth being about the same as for men of eighty-six, and that of girls about the same as that of women at eighty-six or eighty-seven.

The probability of living a year is at its highest point for boys at age twelve (.99722), and for girls it is about the same for age eleven as at age twelve (.99695 and .99693).

A comparison of the death-rates of Massachusetts at different periods presents certain points worthy of notice.

The death-rate of children under five and especially of those under one year of age has not undergone very marked changes (see table) ; but that of all ages from five to forty has very perceptibly diminished, while that of ages above forty has increased. This result has been produced by the great reduction in the number of deaths from infectious diseases, including consumption, which occur in the early period of life, from two years up to thirty. By this means a much larger ratio of the population than formerly survives to live throughout the useful and wage-earning period of life. This causes a material increase in the number of years lived at the later ages of life.

These persons being spared from the diseases incident to childhood, the relative mortality from the diseases of adult life and of old age is naturally increased.

This decided increase in the number of survivors throughout the useful ages of life has a marked effect upon the vitality of the population. It is undoubtedly due in no small degree to the increased attention which has everywhere been given in the past twenty-five years to public hygiene.

The population of almost any one of the United States differs essentially from the more stationary populations of the old world in the fact that it is constantly being recruited by the addition of con-

siderable numbers of immigrants at the healthy ages of life. These additions constitute a selected class, not only on account of their age distribution (50 per cent. are between the ages of fifteen and thirty), but also because many of the weaklings must be left behind, in consequence not only of their inability to become wage-earners but on account of the exclusive action of the immigration laws.*

One consequence of this is the comparatively large number of persons at the later ages of life, an effect which has been produced by the long continuance of immigration.

### DATA FOR CONSTRUCTION OF DIAGRAM OF SURVIVORS.

*Table showing Survivors at Different Ages of Life out of 10,000 born.*

| | Sweden —† 1881-90. | England and Wales —‡ 1881-90. | Massachu- setts — 1893-97. | Massachu- setts —§ 1855. | Spain —‖ 1878-82. |
|---|---|---|---|---|---|
| 0, | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| 1, | 8,895 | 8,536 | 8,400 | 8,449 | 8,083 |
| 2, | 8,586 | 8,067 | 8,054 | 7,733 | 7,060 |
| 3, | 8,399 | 7,878 | 7,896 | 7,424 | 6,433 |
| 4, | 8,258 | 7,758 | 7,786 | 7,258 | 6,151 |
| 10, | 7,882 | 7,495 | 7,487 | 6,873 | 5,747 |
| 15, | 7,713 | 7,423 | 7,366 | 6,726 | 5,602 |
| 20, | 7,551 | 7,281 | 7,167 | 6,437 | 5,413 |
| 25, | 7,338 | 7,090 | 6,906 | 6,100 | 5,164 |
| 30, | 7,109 | 6,844 | 6,615 | 5,748 | 4,908 |
| 35, | 6,876 | 6,550 | 6,308 | 5,408 | 4,596 |
| 40, | 6,628 | 6,216 | 5,988 | 5,078 | 4,378 |
| 45, | 6,349 | 5,839 | 5,651 | 4,748 | 4,088 |
| 50, | 6,043 | 5,405 | 5,275 | 4,409 | 3,765 |
| 55, | 5,687 | 4,891 | 4,821 | 4,022 | 3,381 |
| 60, | 5,239 | 4,275 | 4,272 | 3,597 | 2,914 |
| 65, | 4,658 | 3,534 | 3,622 | 3,065 | 2,327 |
| 70, | 3,900 | 2,684 | 2,869 | 2,475 | 1,666 |
| 75, | 2,948 | 1,786 | 2,042 | 1,833 | 997 |
| 80, | 1,872 | 970 | 1,266 | 1,059 | 465 |
| 85, | 894 | 388 | 654 | 437 | 149 |
| 90, | 275 | 100 | 259 | 118 | 40 |
| 95, | – | 14 | 67 | 20.5 | – |
| 100, | – | .9 | 9 | 2.2 | – |

* "If on examination there shall be found among such passengers any convict, lunatic, idiot or any person unable to take care of himself or herself, without becoming a public charge, . . . such person shall not be permitted to land." (Extract from immigration act of Aug. 3, 1882, section 2.)

† For convenience of comparison with Mr. Elliott's table of 1855, the figures of this table are reduced to a scale of 10,000, while the diagram is made upon a scale of 100,000.

‡ Fifty-fifth Report of Registrar General. Supplement, vol. 1, page xiv. Vol. 10, part 1, page 75.

§ Sixteenth Registration Report, Massachusetts, 1857.

‖ Bulletin de l'institut international de statistique.

NOTE.— In consequence of corrections made after the construction of the diagram on page 819, the line for Massachusetts survivors, 1893-97, should be placed one to two millimeters lower, after age 15.

Survivors
At Different Ages of Life
Out of 100000 Births.

Massachusetts, 1855 ————
Spain , 1878–1882 ————
Sweden, 1881–1890 ————

England and Wales,
1881–1890 ------

Mass., 1893–1897 —··—
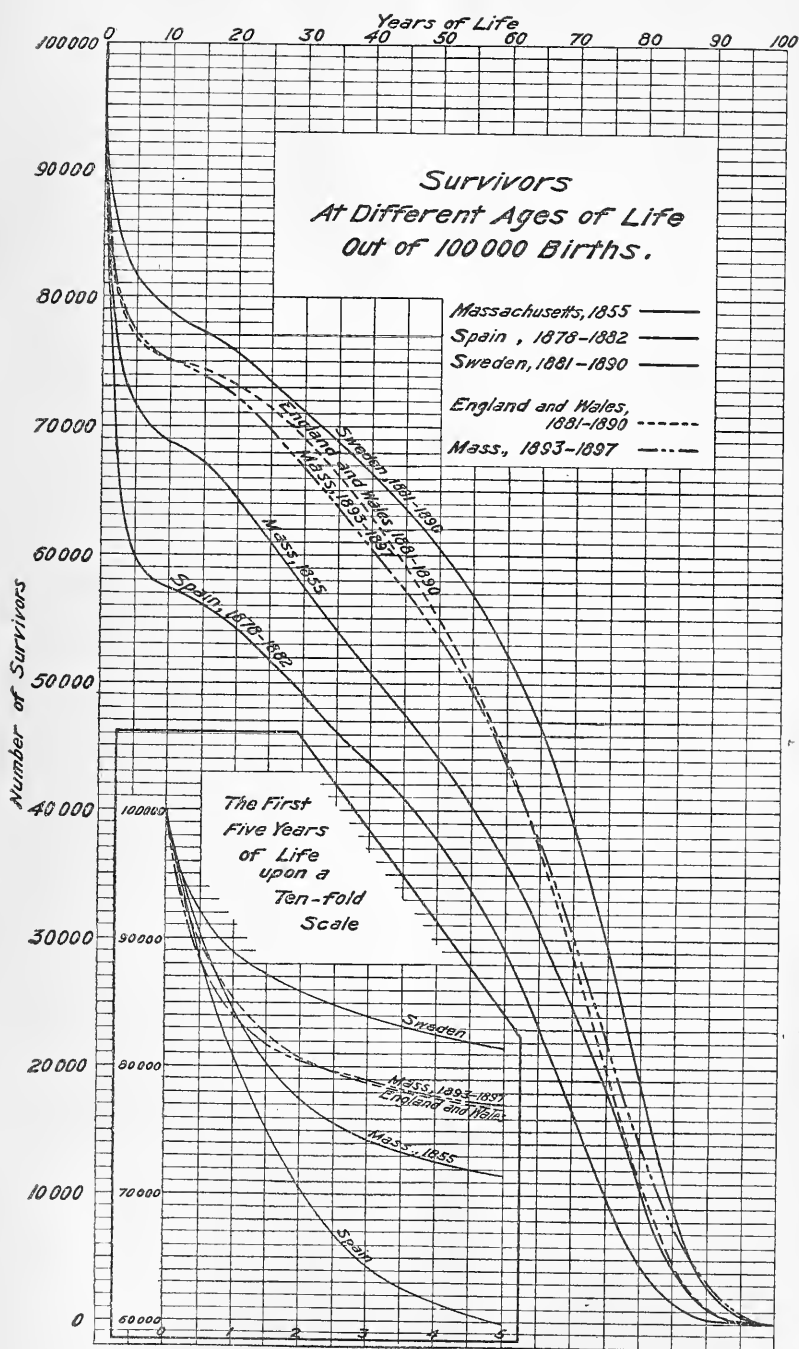
The preceding table and diagram present the numbers of survivors at each of several age periods in Sweden, England, Spain and Massachusetts (in the latter for the year 1855 and for the period of 1893–97). Sweden is selected as a country having a very low death-rate, and also because it is occasionally selected as a standard of a healthy population.   Spain, on the contrary, has a high death-rate, chiefly due to excessive mortality in the early years of life.

In consequence of the close contiguity of the lines in the first five years of life, the figures for the first five years are given upon a separate diagram, in which the divisions representing the age periods are increased ten-fold.

A brief review of the life tables of Massachusetts shows that quite marked changes have taken place from year to year in the life history of the population.

The earliest life table in existence pertaining to the population of Massachusetts is that of Edward Wigglesworth, D.D., of Harvard University, made from records of bills of mortality collected prior to 1789.*   The total number of deaths employed in the construction of this table was 4,893.

Its defects consisted mainly in the limited numbers used for computation, in the crude method of recording the ages of the population by the first census (in five periods only, all under 10, 10–16, 16–26, 26–45, and all over 45), and in the fact that the table was framed on the assumption of a stationary population.   This table was for many years an authority in the courts of the Commonwealth.

In 1855 a table for Massachusetts was published in the Sixteenth Registration Report (1857) by the eminent statistician, Mr. E. B. Elliott.   This table is calculated from 16,086 deaths, which occurred in 166 towns of Massachusetts in the year 1855.†

In the tenth census of the United States, Vol. 12, part 2, pp. 773–791, Dr. Billings publishes approximate life tables for the population of Massachusetts and other States, and for certain cities.   Those of Massachusetts are for the white population of the State, and for the census year 1880, comprising 31,341 deaths, and also for the whole population of the State for the five years ended June 30, 1882, and comprising 171,639 deaths.

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* Published in the second volume of the " Transactions of the American Academy," 1793.

† The calculation was limited to the returns of these 166 towns, since the system of registration then in practice in the State was not believed to be "sufficiently complete to furnish data for a life table for the whole State."   These 166 towns constituted two-thirds of the population of the State in 1855 (Sixteenth Registration Report, Massachusetts, page 199).

The statement of Dr. Josiah Curtis in the Sixteenth Registration Report of Massachusetts (1857)* as to the value of life tables is worthy of note. He says : " There are weightier reasons for desiring correct information concerning the comparative mortality of our communities. The governing powers and enlightened statesmen are enabled better to discharge their high and responsible duties to the people by a correct knowledge of the physical powers, possessions and resources of the inhabitants. . . . The Christian philanthropist and sanitarian will be enabled to give some definiteness and efficiency to their labors, by a correct knowledge of where, and to what purpose, the laws which prevail over life and death teach them to direct their laudable efforts. The question here forcibly arises, Have the records of registration in Massachusetts, or in any considerable portion thereof, ever been sufficiently complete to enable any one to determine with reliable accuracy what law or laws do prevail over the mortality of the inhabitants of the State, or such portions of it? We consider this question, and its answer, taken in their broader sense and application, as the most important practical consideration connected with our system of registration, and it affords extreme gratification to be able to give an affirmative answer to the question. Aside from its intrinsic value, it is creditable to the State of Massachusetts, because it is the first instance where such data have been thus furnished and thus used in any considerable community on this continent. The great practical results in the variety of their applications of such laborious deductions will furnish, not only immediately, but for years to come, the government and intelligent statesmen as well as others, with the means of determining many social and political questions of high practical value hitherto undeterminable."

* Page 197.

## MASSACHUSETTS LIFE TABLE.

### BASED ON THE MORTALITY OF THE FIVE YEARS, 1893–97.

#### TABLE No. 1. — *Males.*

| AGE. $x.$ | Dying in Each Year of Age. $d_x.$ | Born and Surviving at Each Age. $l_x.$ | Population or Years of Life lived in Each Year of Age. $P_x.$ | Years of Life Lived in and above Each Year of Age. $Q_x.$ | Expectation of Life at Each Year of Age. $E_x.$ |
|---|---|---|---|---|---|
| 0, | 8,849 | 51,350 | 46,343 | 2,264,048 | 44.09 |
| 1, | 1,794 | 42,501 | 41,604 | 2,217,705 | 52.18 |
| 2, | 818 | 40,707 | 40,298 | 2,176,101 | 53.46 |
| 3, | 559 | 39,889 | 39,609 | 2,135,803 | 53.54 |
| 4, | 424 | 39,330 | 39,118 | 2,096,194 | 53.30 |
| 5, | 316 | 38,906 | 38,748 | 2,057,076 | 52.88 |
| 6, | 252 | 38,590 | 38,464 | 2,018,328 | 52.30 |
| 7, | 205 | 38,338 | 38,235 | 1,979,864 | 51.64 |
| 8, | 170 | 38,133 | 38,048 | 1,941,629 | 50.92 |
| 9, | 146 | 37,963 | 37,890 | 1,903,581 | 50.14 |
| 10, | 123 | 37,817 | 37,755 | 1,865,691 | 49.33 |
| 11, | 110 | 37,694 | 37,639 | 1,827,936 | 48.49 |
| 12, | 104 | 37,584 | 37,532 | 1,790,297 | 47.63 |
| 13, | 111 | 37,480 | 37,424 | 1,752,765 | 46.76 |
| 14, | 135 | 37,369 | 37,301 | 1,715,341 | 45.90 |
| 15, | 159 | 37,234 | 37,154 | 1,678,040 | 45.07 |
| 16, | 181 | 37,075 | 36,984 | 1,640,886 | 44.26 |
| 17, | 195 | 36,894 | 36,796 | 1,603,902 | 43.47 |
| 18, | 211 | 36,699 | 36,593 | 1,567,106 | 42.70 |
| 19, | 226 | 36,488 | 36,375 | 1,530,513 | 41.94 |
| 20, | 241 | 36,262 | 36,141 | 1,494,138 | 41.20 |
| 21, | 255 | 36,021 | 35,893 | 1,457,997 | 40.48 |
| 22, | 268 | 35,766 | 35,632 | 1,422,104 | 39.76 |
| 23, | 280 | 35,498 | 35,358 | 1,386,472 | 39.06 |
| 24, | 289 | 35,218 | 35,073 | 1,351,114 | 38.36 |
| 25, | 296 | 34,929 | 34,781 | 1,316,041 | 37.68 |
| 26, | 301 | 34,633 | 34,482 | 1,281,260 | 37.00 |
| 27, | 305 | 34,332 | 34,179 | 1,246,778 | 36.32 |
| 28, | 309 | 34,027 | 33,872 | 1,212,599 | 35.64 |
| 29, | 313 | 33,718 | 33,561 | 1,178,727 | 34.96 |
| 30, | 316 | 33,405 | 33,247 | 1,145,166 | 34.28 |
| 31, | 318 | 33,089 | 32,930 | 1,111,919 | 33.60 |
| 32, | 319 | 32,771 | 32,611 | 1,078,989 | 32.93 |
| 33, | 319 | 32,452 | 32,292 | 1,046,378 | 32.24 |
| 34, | 320 | 32,133 | 31,973 | 1,014,086 | 31.56 |
| 35, | 322 | 31,813 | 31,652 | 982,113 | 30.87 |
| 36, | 325 | 31,491 | 31,328 | 950,461 | 30.18 |
| 37, | 328 | 31,166 | 31,002 | 919,133 | 29.49 |
| 38, | 331 | 30,838 | 30,672 | 888,131 | 28.80 |
| 39, | 334 | 30,507 | 30,340 | 857,459 | 28.11 |
| 40, | 337 | 30,173 | 30,004 | 827,119 | 27.41 |
| 41, | 341 | 29,836 | 29,665 | 797,115 | 26.72 |
| 42, | 346 | 29,495 | 29,322 | 767,450 | 26.02 |
| 43, | 352 | 29,149 | 28,973 | 738,128 | 25.32 |
| 44, | 359 | 28,797 | 28,617 | 709,155 | 24.63 |
| 45, | 368 | 28,438 | 28,254 | 680,538 | 23.93 |
| 46, | 379 | 28,070 | 27,880 | 652,284 | 23.24 |
| 47, | 393 | 27,691 | 27,494 | 624,404 | 22.55 |
| 48, | 410 | 27,298 | 27,093 | 596,910 | 21.87 |
| 49, | 429 | 26,888 | 26,673 | 569,817 | 21.19 |

## MASSACHUSETTS LIFE TABLE.

### BASED ON THE MORTALITY OF THE FIVE YEARS, 1893-97.

#### TABLE NO. 1. — *Males* — Concluded.

| AGE. $x.$ | Dying in Each Year of Age. $d_x.$ | Born and Surviving at Each Age. $l_x.$ | Population or Years of Life lived in Each Year of Age. $P_x.$ | Years of Life Lived in and above Each Year of Age. $Q_x.$ | Expectation of Life at Each Year of Age. $E_x.$ |
|---|---|---|---|---|---|
| 50, | 448 | 26,459 | 26,235 | 543,144 | 20.53 |
| 51, | 466 | 26,011 | 25,778 | 516,909 | 19.87 |
| 52, | 483 | 25,545 | 25,303 | 491,131 | 19.23 |
| 53, | 502 | 25,062 | 24,811 | 465,828 | 18.59 |
| 54, | 520 | 24,560 | 24,300 | 441,017 | 17.96 |
| 55, | 539 | 24,040 | 23,770 | 416,717 | 17.33 |
| 56, | 561 | 23,501 | 23,220 | 392,947 | 16.72 |
| 57, | 585 | 22,940 | 22,647 | 369,727 | 16.12 |
| 58, | 608 | 22,355 | 22,051 | 347,080 | 15.53 |
| 59, | 636 | 21,747 | 21,429 | 325,029 | 14.95 |
| 60, | 659 | 21,111 | 20,781 | 303,600 | 14.38 |
| 61, | 677 | 20,452 | 20,113 | 282,819 | 13.83 |
| 62, | 691 | 19,775 | 19,429 | 262,706 | 13.28 |
| 63, | 709 | 19,084 | 18,729 | 243,277 | 12.75 |
| 64, | 729 | 18,375 | 18,010 | 224,548 | 12.22 |
| 65, | 748 | 17,646 | 17,272 | 206,538 | 11.70 |
| 66, | 769 | 16,898 | 16,513 | 189,266 | 11.20 |
| 67, | 789 | 16,129 | 15,734 | 172,753 | 10.71 |
| 68, | 810 | 15,340 | 14,935 | 157,019 | 10.24 |
| 69, | 827 | 14,530 | 14,116 | 142,084 | 9.78 |
| 70, | 840 | 13,703 | 13,283 | 127,968 | 9.34 |
| 71, | 845 | 12,863 | 12,440 | 114,685 | 8.92 |
| 72, | 847 | 12,018 | 11,594 | 102,245 | 8.51 |
| 73, | 842 | 11,171 | 10,750 | 90,651 | 8.11 |
| 74, | 831 | 10,329 | 9,913 | 79,901 | 7.74 |
| 75, | 816 | 9,498 | 9,090 | 69,988 | 7.37 |
| 76, | 794 | 8,682 | 8,285 | 60,898 | 7.01 |
| 77, | 769 | 7,888 | 7,503 | 52,613 | 6.67 |
| 78, | 741 | 7,119 | 6,748 | 45,110 | 6.34 |
| 79, | 707 | 6,378 | 6,024 | 38,362 | 6.01 |
| 80, | 672 | 5,671 | 5,335 | 32,338 | 5.70 |
| 81, | 632 | 4,999 | 4,683 | 27,003 | 5.40 |
| 82, | 590 | 4,367 | 4,072 | 22,320 | 5.11 |
| 83, | 546 | 3,777 | 3,504 | 18,248 | 4.83 |
| 84, | 499 | 3,231 | 2,981 | 14,744 | 4.56 |
| 85, | 452 | 2,732 | 2,506 | 11,763 | 4.31 |
| 86, | 402 | 2,280 | 2,079 | 9,257 | 4.06 |
| 87, | 353 | 1,878 | 1,701 | 7,178 | 3.82 |
| 88, | 307 | 1,525 | 1,371 | 5,477 | 3.59 |
| 89, | 263 | 1,218 | 1,086 | 4,106 | 3.37 |
| 90, | 220 | 955 | 845 | 3,020 | 3.16 |
| 91, | 181 | 735 | 644 | 2,175 | 2.96 |
| 92, | 146 | 554 | 481 | 1,531 | 2.76 |
| 93, | 116 | 408 | 350 | 1,050 | 2.57 |
| 94, | 88 | 292 | 248 | 700 | 2.40 |
| 95, | 66 | 204 | 171 | 452 | 2.22 |
| 96, | 48 | 138 | 114 | 281 | 2.04 |
| 97, | 33 | 90 | 73 | 167 | 1.86 |
| 98, | 23 | 57 | 45 | 94 | 1.65 |
| 99, | 15 | 34 | 26 | 49 | 1.44 |
| 100, | 9 | 19 | 14 | 23 | 1.21 |

## MASSACHUSETTS LIFE TABLE.

### Based on the Mortality of the Five Years, 1893-97.

#### Table No. 2. — *Females.*

| Age. $x.$ | Dying in Each Year of Age. $d_x.$ | Born and Surviving at Each Age. $l_x.$ | Population or Years of Life lived in Each Year of Age. $P_x.$ | Years of Life Lived in and above Each Year of Age. $Q_x.$ | Expectation of Life at Each Year of Age. $E_x.$ |
|---|---|---|---|---|---|
| 0, | 7,151 | 48,650 | 43,907 | 2,267,469 | 46.61 |
| 1, | 1,662 | 41,499 | 40,668 | 2,223,562 | 53.58 |
| 2, | 763 | 39,837 | 39,455 | 2,182,894 | 54.79 |
| 3, | 544 | 39,074 | 38,802 | 2,143,439 | 54.83 |
| 4, | 385 | 38,530 | 38,337 | 2,104,637 | 54.62 |
| 5, | 318 | 38,145 | 37,986 | 2,066,300 | 54.17 |
| 6, | 250 | 37,827 | 37,702 | 2,028,314 | 53.62 |
| 7, | 206 | 37,577 | 37,474 | 1,990,612 | 52.97 |
| 8, | 170 | 37,371 | 37,286 | 1,953,138 | 52.26 |
| 9, | 147 | 37,201 | 37,127 | 1,915,852 | 51.50 |
| 10, | 129 | 37,054 | 36,990 | 1,878,725 | 50.70 |
| 11, | 113 | 36,925 | 36,868 | 1,841,735 | 49.88 |
| 12, | 113 | 36,812 | 36,755 | 1,804,867 | 49.03 |
| 13, | 123 | 36,699 | 36,637 | 1,768,112 | 48.18 |
| 14, | 146 | 36,576 | 36,503 | 1,731,475 | 47.34 |
| 15, | 172 | 36,430 | 36,344 | 1,694,972 | 46.53 |
| 16, | 195 | 36,258 | 36,160 | 1,658,628 | 45.74 |
| 17, | 206 | 36,063 | 35,960 | 1,622,468 | 44.99 |
| 18, | 218 | 35,857 | 35,748 | 1,586,508 | 44.24 |
| 19, | 230 | 35,639 | 35,524 | 1,550,760 | 43.51 |
| 20, | 241 | 35,409 | 35,288 | 1,515,236 | 42.79 |
| 21, | 251 | 35,168 | 35,042 | 1,479,948 | 42.08 |
| 22, | 255 | 34,917 | 34,790 | 1,444,906 | 41.38 |
| 23, | 261 | 34,662 | 34,531 | 1,410,116 | 40.68 |
| 24, | 265 | 34,401 | 34,268 | 1,375,585 | 39.99 |
| 25, | 269 | 34,136 | 34,001 | 1,341,317 | 39.29 |
| 26, | 274 | 33,867 | 33,730 | 1,307,316 | 38.60 |
| 27, | 278 | 33,593 | 33,454 | 1,273,586 | 37.91 |
| 28, | 282 | 33,315 | 33,174 | 1,240,132 | 37.22 |
| 29, | 286 | 33,033 | 32,890 | 1,206,958 | 36.54 |
| 30, | 290 | 32,747 | 32,602 | 1,174,068 | 35.85 |
| 31, | 294 | 32,457 | 32,310 | 1,141,466 | 35.17 |
| 32, | 297 | 32,163 | 32,014 | 1,109,156 | 34.48 |
| 33, | 301 | 31,866 | 31,715 | 1,077,142 | 33.80 |
| 34, | 302 | 31,565 | 31,414 | 1,045,427 | 33.12 |
| 35, | 306 | 31,263 | 31,110 | 1,014,013 | 32.43 |
| 36, | 308 | 30,957 | 30,803 | 982,903 | 31.75 |
| 37, | 312 | 30,649 | 30,493 | 952,100 | 31.06 |
| 38, | 315 | 30,337 | 30,180 | 921,607 | 30.38 |
| 39, | 318 | 30,022 | 29,863 | 891,427 | 29.69 |
| 40, | 320 | 29,704 | 29,544 | 861,564 | 29.00 |
| 41, | 324 | 29,384 | 29,222 | 832,020 | 28.31 |
| 42, | 326 | 29,060 | 28,897 | 802,798 | 27.62 |
| 43, | 329 | 28,734 | 28,570 | 773,901 | 26.93 |
| 44, | 332 | 28,405 | 28,239 | 745,331 | 26.24 |
| 45, | 335 | 28,073 | 27,905 | 717,092 | 25.54 |
| 46, | 346 | 27,738 | 27,565 | 689,187 | 24.85 |
| 47, | 354 | 27,392 | 27,215 | 661,622 | 24.15 |
| 48, | 367 | 27,038 | 26,854 | 634,407 | 23.46 |
| 49, | 379 | 26,671 | 26,481 | 607,553 | 22.78 |

## MASSACHUSETTS LIFE TABLE.

### BASED ON THE MORTALITY OF THE FIVE YEARS, 1893-97.

TABLE No. 2. — *Females* — Concluded.

| Age.<br>$x.$ | | | | | | | Dying in<br>Each Year<br>of Age.<br>$d_x.$ | Born and<br>Surviving at<br>Each Age.<br>$l_x.$ | Population<br>or Years of Life<br>lived in Each<br>Year of Age.<br>$P_x.$ | Years of Life<br>Lived in and<br>above Each<br>Year of Age.<br>$Q_x.$ | Expectation<br>of Life at<br>Each Year of<br>Age.<br>$E_x.$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50, | · | · | · | · | · | · | 395 | 26,292 | 26,094 | 581,072 | 22.10 |
| 51, | · | · | · | · | · | · | 410 | 25,897 | 25,692 | 554,978 | 21.43 |
| 52, | · | · | · | · | · | · | 423 | 25,487 | 25,275 | 529,286 | 20.77 |
| 53, | · | · | · | · | · | · | 437 | 25,064 | 24,845 | 504,011 | 20.11 |
| 54, | · | · | · | · | · | · | 457 | 24,627 | 24,398 | 479,166 | 19.46 |
| 55, | · | · | · | · | · | · | 476 | 24,170 | 23,932 | 454,768 | 18.81 |
| 56, | · | · | · | · | · | · | 494 | 23,694 | 23,447 | 430,836 | 18.18 |
| 57, | · | · | · | · | · | · | 512 | 23,200 | 22,944 | 407,389 | 17.56 |
| 58, | · | · | · | · | · | · | 530 | 22,688 | 22,423 | 384,445 | 16.95 |
| 59, | · | · | · | · | · | · | 550 | 22,158 | 21,883 | 362,022 | 16.34 |
| 60, | · | · | · | · | · | · | 572 | 21,608 | 21,322 | 340,139 | 15.74 |
| 61, | · | · | · | · | · | · | 588 | 21,036 | 20,742 | 318,817 | 15.16 |
| 62, | · | · | · | · | · | · | 606 | 20,448 | 20,145 | 298,075 | 14.58 |
| 63, | · | · | · | · | · | · | 625 | 19,842 | 19,530 | 277,930 | 14.01 |
| 64, | · | · | · | · | · | · | 644 | 19,217 | 18,895 | 258,400 | 13.45 |
| 65, | · | · | · | · | · | · | 665 | 18,573 | 18,240 | 239,505 | 12.90 |
| 66, | · | · | · | · | · | · | 689 | 17,908 | 17,563 | 221,265 | 12.36 |
| 67, | · | · | · | · | · | · | 715 | 17,219 | 16,861 | 203,702 | 11.83 |
| 68, | · | · | · | · | · | · | 743 | 16,504 | 16,132 | 186,841 | 11.32 |
| 69, | · | · | · | · | · | · | 771 | 15,761 | 15,375 | 170,709 | 10.83 |
| 70, | · | · | · | · | · | · | 793 | 14,990 | 14,593 | 155,334 | 10.36 |
| 71, | · | · | · | · | · | · | 809 | 14,197 | 13,792 | 140,741 | 9.91 |
| 72, | · | · | · | · | · | · | 821 | 13,388 | 12,977 | 126,949 | 9.48 |
| 73, | · | · | · | · | · | · | 825 | 12,567 | 12,154 | 113,972 | 9.07 |
| 74, | · | · | · | · | · | · | 824 | 11,742 | 11,330 | 101,818 | 8.67 |
| 75, | · | · | · | · | · | · | 818 | 10,918 | 10,509 | 90,488 | 8.29 |
| 76, | · | · | · | · | · | · | 806 | 10,100 | 9,697 | 79,979 | 7.92 |
| 77, | · | · | · | · | · | · | 790 | 9,294 | 8,899 | 70,282 | 7.56 |
| 78, | · | · | · | · | · | · | 768 | 8,504 | 8,120 | 61,383 | 7.22 |
| 79, | · | · | · | · | · | · | 742 | 7,736 | 7,365 | 53,263 | 6.89 |
| 80, | · | · | · | · | · | · | 711 | 6,994 | 6,638 | 45,898 | 6.56 |
| 81, | · | · | · | · | · | · | 678 | 6,283 | 5,944 | 39,260 | 6.25 |
| 82, | · | · | · | · | · | · | 640 | 5,605 | 5,285 | 33,316 | 5.94 |
| 83, | · | · | · | · | · | · | 600 | 4,965 | 4,665 | 28,031 | 5.65 |
| 84, | · | · | · | · | · | · | 559 | 4,365 | 4,085 | 23,366 | 5.35 |
| 85, | · | · | · | · | · | · | 518 | 3,806 | 3,547 | 19,281 | 5.07 |
| 86, | · | · | · | · | · | · | 476 | 3,288 | 3,050 | 15,734 | 4.79 |
| 87, | · | · | · | · | · | · | 434 | 2,812 | 2,595 | 12,684 | 4.51 |
| 88, | · | · | · | · | · | · | 393 | 2,378 | 2,181 | 10,089 | 4.33 |
| 89, | · | · | · | · | · | · | 351 | 1,985 | 1,810 | 7,908 | 3.98 |
| 90, | · | · | · | · | · | · | 310 | 1,634 | 1,479 | 6,098 | 3.73 |
| 91, | · | · | · | · | · | · | 270 | 1,324 | 1,189 | 4,619 | 3.49 |
| 92, | · | · | · | · | · | · | 232 | 1,054 | 938 | 3,430 | 3.25 |
| 93, | · | · | · | · | · | · | 194 | 822 | 725 | 2,492 | 3.03 |
| 94, | · | · | · | · | · | · | 160 | 628 | 548 | 1,767 | 2.81 |
| 95, | · | · | · | · | · | · | 129 | 468 | 403 | 1,219 | 2.60 |
| 96, | · | · | · | · | · | · | 100 | 339 | 289 | 816 | 2.41 |
| 97, | · | · | · | · | · | · | 77 | 239 | 200 | 527 | 2.20 |
| 98, | · | · | · | · | · | · | 55 | 162 | 134 | 327 | 2.02 |
| 99, | · | · | · | · | · | · | 40 | 107 | 87 | 193 | 1.80 |
| 100, | · | · | · | · | · | · | 27 | 67 | 53 | 106 | 1.58 |

## MASSACHUSETTS LIFE TABLE.

### BASED ON THE MORTALITY OF THE FIVE YEARS, 1893-97.

#### TABLE No. 3.

| Age. $x$. | $m_x$ Annual Mortality per Unit at Each Year of Age. Males. | Females. | $p_x$ Probability of Living One Year from Each Age. Males. | Females. | Age. $x$. | $m_x$ Annual Mortality per Unit at Each Year of Age. Males. | Females. | $p_x$ Probability of Living One Year from Each Age. Males. | Females. |
|---|---|---|---|---|---|---|---|---|---|
| 0, | .19095 | .16287 | .82569 | .84939 | 50, | .01708 | .01514 | .98307 | .98498 |
| 1, | .04313 | .04087 | .95778 | .95995 | 51, | .01808 | .01596 | .98208 | .98417 |
| 2, | .02030 | .01933 | .97990 | .98085 | 52, | .01909 | .01674 | .98109 | .98340 |
| 3, | .01411 | .01403 | .98599 | .98607 | 53, | .02023 | .01759 | .97997 | .98256 |
| 4, | .01084 | .01004 | .98922 | .99001 | 54, | .02140 | .01873 | .97888 | .98144 |
| 5, | .00815 | .00835 | .99188 | .99168 | 55, | .02268 | .01989 | .97758 | .98031 |
| 6, | .00655 | .00663 | .99347 | .99339 | 56, | .02416 | .02107 | .97613 | .97915 |
| 7, | .00536 | .00550 | .99464 | .99452 | 57, | .02583 | .02231 | .97450 | .97793 |
| 8, | .00447 | .00456 | .99556 | .99546 | 58, | .02757 | .02364 | .97280 | .97664 |
| 9, | .00386 | .00396 | .99616 | .99606 | 59, | .02968 | .02513 | .97075 | .97518 |
| 10, | .00326 | .00349 | .99675 | .99652 | 60, | .03171 | .02683 | .96878 | .97353 |
| 11, | .00292 | .00306 | .99709 | .99695 | 61, | .03366 | .02835 | .96639 | .97205 |
| 12, | .00277 | .00307 | .99722 | .99693 | 62, | .03557 | .03008 | .96505 | .97037 |
| 13, | .00297 | .00336 | .99703 | .99665 | 63, | .03786 | .03200 | .96285 | .96850 |
| 14, | .00362 | .00400 | .99640 | .99601 | 64, | .04048 | .03408 | .96032 | .96648 |
| 15, | .00428 | .00473 | .99573 | .99528 | 65, | .04331 | .03646 | .95761 | .96419 |
| 16, | .00489 | .00539 | .99511 | .99464 | 66, | .04657 | .03923 | .95449 | .96152 |
| 17, | .00530 | .00573 | .99471 | .99429 | 67, | .05015 | .04241 | .95107 | .95848 |
| 18, | .00577 | .00610 | .99425 | .99392 | 68, | .05424 | .04606 | .94719 | .95498 |
| 19, | .00621 | .00647 | .99381 | .99356 | 69, | .05859 | .05015 | .94307 | .95108 |
| 20, | .00667 | .00683 | .99335 | .99320 | 70, | .06324 | .05434 | .93869 | .94710 |
| 21, | .00710 | .00716 | .99292 | .99286 | 71, | .06793 | .05866 | .93430 | .94301 |
| 22, | .00752 | .00733 | .99251 | .99268 | 72, | .07306 | .06327 | .92951 | .93867 |
| 23, | .00792 | .00756 | .99212 | .99249 | 73, | .07833 | .06788 | .92462 | .93435 |
| 24, | .00824 | .00773 | .99179 | .99230 | 74, | .08383 | .07273 | .91954 | .92983 |
| 25, | .00851 | .00791 | .99153 | .99212 | 75, | .08977 | .07784 | .91409 | .92508 |
| 26, | .00873 | .00812 | .99131 | .99192 | 76, | .09584 | .08312 | .90854 | .92020 |
| 27, | .00892 | .00831 | .99112 | .99170 | 77, | .10249 | .08877 | .90251 | .91500 |
| 28, | .00912 | .00850 | .99092 | .99154 | 78, | .10981 | .09458 | .89591 | .90969 |
| 29, | .00933 | .00870 | .99072 | .99134 | 79, | .11736 | .10075 | .88915 | .90408 |
| 30, | .00950 | .00890 | .99054 | .99114 | 80, | .12596 | .10711 | .88150 | .89834 |
| 31, | .00966 | .00910 | .99039 | .99094 | 81, | .13496 | .11406 | .87357 | .89209 |
| 32, | .00978 | .00928 | .99026 | .99077 | 82, | .14489 | .12110 | .86490 | .88581 |
| 33, | .00988 | .00949 | .99017 | .99055 | 83, | .15582 | .12862 | .85544 | .87915 |
| 34, | .01001 | .00961 | .99004 | .99043 | 84, | .16739 | .13684 | .84554 | .87192 |
| 35, | .01017 | .00984 | .98988 | .99021 | 85, | .18037 | .14604 | .83455 | .86390 |
| 36, | .01037 | .01000 | .98968 | .99005 | 86, | .19336 | .15607 | .82369 | .85523 |
| 37, | .01058 | .01023 | .98948 | .98982 | 87, | .20752 | .16724 | .81199 | .84567 |
| 38, | .01079 | .01044 | .98927 | .98962 | 88, | .22392 | .18019 | .79863 | .83470 |
| 39, | .01101 | .01063 | .98905 | .98942 | 89, | .24217 | .19392 | .78399 | .82322 |
| 40, | .01123 | .01083 | .98881 | .98923 | 90, | .26036 | .20960 | .76963 | .81028 |
| 41, | .01150 | .01109 | .98857 | .98897 | 91, | .28106 | .22708 | .75357 | .79607 |
| 42, | .01180 | .01128 | .98827 | .98878 | 92, | .30353 | .24733 | .73647 | .77989 |
| 43, | .01215 | .01152 | .98792 | .98855 | 93, | .33143 | .26759 | .71569 | .76399 |
| 44, | .01255 | .01176 | .98753 | .98831 | 94, | .35484 | .29197 | .69863 | .74522 |
| 45, | .01302 | .01200 | .98706 | .98802 | 95, | .38596 | .32010 | .67647 | .72406 |
| 46, | .01359 | .01255 | .98650 | .98753 | 96, | .42105 | .34602 | .65218 | .70502 |
| 47, | .01430 | .01301 | .98581 | .98708 | 97, | .45206 | .38500 | .63128 | .67715 |
| 48, | .01513 | .01367 | .98498 | .98643 | 98, | .51111 | .41045 | .59292 | .65944 |
| 49, | .01608 | .01431 | .98404 | .98579 | 99, | .57692 | .45977 | .55224 | .62617 |
|  |  |  |  |  | 100, | .64286 | .50943 | .51351 | .59399 |

The following table presents the mean annual death-rates at each of thirteen periods or groups of years, beginning with birth, for the five years (1893–97). To these are added as a matter of convenience the death-rates at certain other groups (1–4, 0–9, etc.).

TABLE No. 4.

*Mean Annual Death-rates at Certain Periods of Life.*

| AGE PERIODS. | | | | PERSONS.<br>Death-rate<br>at Each<br>Period. | MALES.<br>Death-rate<br>at Each<br>Period. | FEMALES.<br>Death-rate<br>at Each<br>Period. | AGE PERIODS. | | | | PERSONS.<br>Death-rate<br>at Each<br>Period. | MALES.<br>Death-rate<br>at Each<br>Period. | FEMALES.<br>Death-rate<br>at Each<br>Period. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0–4, | . | . | . | 56.23 | 60.12 | 52.22 | 45–54, | . | . | . | 15.78 | 16.67 | 14.88 |
| 5–9, | . | . | . | 5.75 | 5.69 | 5.82 | 55–64, | . | . | . | 28.18 | 30.42 | 26.00 |
| 10–14, | . | . | . | 3.25 | 3.11 | 3.40 | 65–74, | . | . | . | 55.34 | 59.67 | 51.37 |
| 15–19, | . | . | . | 5.48 | 5.29 | 5.68 | 75–84, | . | . | . | 107.22 | 116.20 | 99.88 |
| 20–24, | . | . | . | 7.40 | 7.48 | 7.32 | 85–94, | . | . | . | 199.71 | 223.50 | 184.81 |
| 25–34, | . | . | . | 9.06 | 9.33 | 8.78 | 95+ | . | . | . | 384.43 | 429.20 | 367.07 |
| 35–44, | . | . | . | 10.97 | 11.19 | 10.74 | | | | | | | |

*Additional Groups or Periods.*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1–4, | . | . | . | 21.86 | 22.38 | 21.33 | 1–19, | . | . | . | 8.61 | 8.62 | 8.60 |
| 0–9, | . | . | . | 31.93 | 33.97 | 29.83 | 20–59, | . | . | . | 12.24 | 12.73 | 11.74 |
| 1–9, | . | . | . | 13.10 | 13.31 | 12.89 | 60 and over, | | | . | 66.29 | 69.50 | 63.42 |
| 0–14, | . | . | . | 22.73 | 24.09 | 21.35 | | | | | | | |